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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E.

Semester: III

Branch: Aerospace Engineering

Duration: 3 hrs.

Course Code: 23AS3PCIAE

Max Marks: 100

Course: Introduction to Aerospace Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			UNIT - I			CO	PO	Marks
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.	1	a)	Explain the different layers of atmosphere with a graph showing the temperature and pressure variation.		CO1	PO1		8
		b)	With the help of a suitable block diagram, list and explain the major components of a spacecraft.		CO1	PO1		8
		c)	Define Reynold's number and its value for a laminar flow in a closed tube.		CO1	PO1		4
OR								
	2	a)	Enumerate the spacecraft classification and also give its detailed explanation with a suitable example for each type.		CO1	PO1		10
		b)	Calculate the standard atmosphere values of T, p and ρ at an altitude of 14 km.		CO3	PO3		10
UNIT - II								
	3	a)	Estimate the lift-off distance for the CJ-1 at sea level. Assume a paved runway: $\mu_r = 0.02$. During the ground roll, the angle of attack of the airplane is restricted by the requirement that the tail not drag the ground; so assume that $C_{L,max}$ during ground roll is limited to 1.0. Also, when the airplane is on the ground, the wings are 6 ft above the ground. Assume wingspan is 53.5ft, wing area is 318ft^2 , normal gross weight is 19,815lb, fuel capacity is 1119 gal of kerosene, specific fuel consumption is 0.6 lb of fuel, two turbofan engines of 3650 lb thrust each at sea level, $C_{D,0}$ is 0.02, e is 0.81 and air density is $0.002377 \text{ slug}/\text{ft}^3$.		CO3	PO3		8
		b)	Derive the expression to find out the length of ground roll required for a lift-off (S_{LO}).		CO2	PO3		8

	c)	With the help of suitable sketches, explain the nomenclature of an aerofoil.	CO1	PO1	4
		OR			
4	a)	Estimate the landing ground roll distance at sea level for the CJ-1. No thrust reversal is used; however, spoilers are employed so that $L = 0$. The spoilers increase the zero lift drag coefficient by 10 percent. The fuel tanks are essentially empty, so neglect the weight of any fuel carried by the airplane. The maximum lift coefficient, with flaps fully deployed at touchdown, is 2.5. Assume that the empty weight of the CJ-1 is 12,352 lb, $C_{D,0}$ is 0.02, $\mu_r = 0.4$, wing area is 318ft^2 , air density is $0.002377 \text{ slug/ft}^3$.	CO3	PO3	10
	b)	List out the factors that affect drag of an aircraft and also give detailed explanation for each factor with suitable diagrams.	CO2	PO1	10
		UNIT - III			
5	a)	With the help of neat sketch explain the working of a liquid and solid propellant engines.	CO1	PO1	6
	b)	Consider a turbojet-powered airplane flying at a standard altitude of 30,000 ft at a velocity of 500 mi/h. The turbojet engine itself has inlet and exit areas of 7 and 4.5 ft^2 , respectively. The velocity and pressure of the exhaust gas at the exit are 1600 ft/s and 640 lb/ ft^2 , respectively. At a standard altitude of 30,000ft, $p_\infty = 629.66 \text{ lb/ft}^2$ and $\rho_\infty = 8.9068 \times 10^{-4}$. Calculate the thrust of the turbojet.	CO3	PO3	6
	c)	With the help of cycle of operation, T-S diagram and P-V diagram, explain the working principle of Brayton cycle.	CO1	PO1	8
		OR			
6	a)	A jet propulsion unit, with turbojet engine, having a forward speed of 1,100 km/hr produces 14 KN of thrust and uses 40 kg of air per second. Find i) The relative exit jet velocity ii) the thrust power iii) the propulsive power and iv) the propulsive efficiency.	CO3	PO3	8
	b)	Derive the thrust equation of a Jet Engine.	CO1	PO1	6
	c)	With the help of neat sketch explain the working of scramjet engine.	CO1	PO1	6
		UNIT - IV			
7	a)	List the uses of <ul style="list-style-type: none"> i) Aluminium alloys ii) Titanium iii) Stainless Steel iv) Composites 	CO1	PO1	12
	b)	Explain the truss type construction of a fuselage.	CO1	PO1	4

		c)	Differentiate Truss type and monocoque type of fuselage construction.	CO1	PO1	4
			OR			
	8	a)	Explain the wing structure of an aircraft with the help of a neat sketch.	CO1	PO1	7
		b)	Explain briefly the semi-monocoque construction of a fuselage.	CO1	PO1	7
		c)	Explain about metallic and non-metallic materials used for aircraft.	CO1	PO1	6
			UNIT - V			
	9	a)	Explain the emerging technologies in aircraft manufacturing.	CO1	PO1	7
		b)	What are the different types of key space concepts and key counterspace concepts? Explain each one of its kind in detail.	CO1	PO1	8
		c)	Define Crashworthiness. Explain in detail about crashworthy systems.	CO3	PO2	5
			OR			
	10	a)	Explain the emerging technology trends in aviation industry.	CO3	PO2	7
		b)	Mention the top aerospace companies in India and their role.	CO2	PO1	6
		c)	Mention and define the challenges being faced by the aerospace industry with growing technology.	CO2	PO1	7
